EFFICACY OF METHYL IODIDE AGAINST ROOT-KNOT NEMATODES IN BUCKET AND FIELD TRIALS

J.O. Becker[1], N.M. Grech[2], H.D. Ohr[2], M. Mc Giffin[3], and J.J. Sims[2]
[1]Departments of Nematology, [2]Plant Pathology, [3]Botany and Plant Sciences, University of California, Riverside, CA, 92521

The impending US ban of methyl bromide without a replacement similar in efficacy and spectrum will have a profound impact on several crop production systems. While some growers may be able to adapt their production system to emphasize integrated pest management, others will certainly fail to economically compete within the US market or with foreign imports (Noling and Becker, 1994). Recently, we have reported that methyl iodide is a likely candidate to replace methyl bromide (Becker et al., 1995, Ohr et al., 1995), provided it passes the EPA registration requirements. In preliminary laboratory studies, its efficacy against a wide range of pest and pathogens proved to be comparable to or better than methyl bromide at equivalent molar rates. Due to its short atmospheric life-time, methyl iodide is expected to have an insignificantly small ozone depletion potential. Furthermore, as a liquid with a boiling point of 42.5°C, it is safer to handle than methyl bromide. The objective of this research was to expand on our laboratory results and compare the dose response of methyl bromide with methyl iodide in bucket trials against root-knot nematodes, *Meloidogyne incognita*. Furthermore, we evaluated the performance of methyl iodide in a field site which was naturally infested with root-knot nematodes.

In the first set of trials, 22.3 L plastic buckets filled with sandy soil served as experimental units. Holes in the bottom allowed drainage and aeration. All trials were designed as randomized complete blocks with four replicates per treatment. Small muslin bags filled with soil infested with root-knot nematode eggs were placed onto a 10cm-deep soil layer in the bottom of each bucket. They were covered with 20 cm-deep layer of the same soil. Soil moisture in all trials was between 5-8%. Soil temperature at the time of treatments and during the time the buckets remained covered was between 15°C and 24°C. The fumigants were cooled to -56°C and pipetted into small gas-tight glass vials. These were placed onto the soil surface and opened. The buckets were immediately covered with 0.1mm black polyethylene tarp and held in place by a large rubber band. Four days later, the tarps were removed. After another day, the bags were recovered and placed on Baermann funnels to allow hatching of the nematodes. After five days, the larvae were collected and counted. The experiment was repeated three times.

A field trial was conducted during the summer of 1995 at the UC South Coast Research and Extension Center near Irvine, CA. In the previous season, the site was planted to tomato and infested with *M. incognita*. The galled roots were left in the ground to create a strong infestation pressure. The trial was designed as a randomized complete block with four replications set up on 1m-wide beds on 1.52 m centers. Surface, low-volume irrigation lines with 2 L/hr emitters, spaced at 30 cm intervals, were used to moisten the soil before application. All plots which received methyl iodide and a non-treated control were covered with 0.025 mm clear plastic. The fumigant was applied by inserting glass pipettes through the plastic covers and approximately 5 cm deep into the soil. The total amount per treatment was distributed in quarter portions at four insertion points at equal distance from each other. After removal of the pipettes, the holes in the cover were immediately sealed with self-sticking tape. After four days the plastic covers were removed. One week later six 25 cm soil cores were taken from each bed, combined, mixed and analyzed for root-knot nematodes by the Baermann Funnel method. Lima beans (*Phaseolus lunatus* L. cv. Henderson) were seeded in two rows per bed, separated in the middle by the irrigation lines. Two months later, ten plants were removed from each bed and their root system was rated for root-knot galling. All data were subjected to analysis of variance and Fisher's protected least significant difference test ($p=0.05$).

The bucket trials were designed for a direct comparison of the two fumigants under near ideal conditions. In all trials methyl iodide was slightly but significantly more active against root-knot nematodes than methyl bromide. Representative trial results are given in Fig. 1. At a methyl iodide concentration of 11.9 mM/m^2 (equivalent to approximately 10 lbs/acre), no surviving nematode was detected in the samples. Under more realistic conditions, the field trial results indicated that an application rate of 100 lbs methyl iodide per acre would probably be adequate to achieve sufficient control of *M. incognita* even though some root galling occurred (Fig. 2). However, it should be noted that the trial was conducted under very heavy root-knot nematode infestation pressure and that the technique of applying methyl iodide has not been optimized. Baines et al. (1966) reported similar rates to be effective for methyl bromide in field trials against the citrus nematode (*Tylenchulus semipenetrans*).

In summary, these bucket and field trials confirm our previous investigations about the excellent efficacy of methyl iodide against nematode pests. It should be considered a prime candidate for replacing methyl bromide.

Baines, R.C., L.J. Klotz, T.A. DeWolfe, R.H. Small, and G.O. Turner (1966). Nematocidal and fungicidal properties of some soil fumigants. Phytopathology 56, 691-698.

Becker, J. O., H.D. Ohr, and J.J. Sims (1995). Methyl iodide: a possible methyl bromide sustitute for soil fumigation against plant parasitic nematodes. Journal of Nematology 27, (in press).

Noling, J.W., and J.O. Becker (1994). The challenge of research and extension to define and implement alternatives to methyl bromide. Journal of Nematology 26 (4S), 573-586.

Ohr, H.D., J.J. Sims, N.M. Grech, and J.O. Becker (1995). Methyl iodide, a direct replacement for methyl bromide as a soil fumigant. Phytopathology 85, (in press).

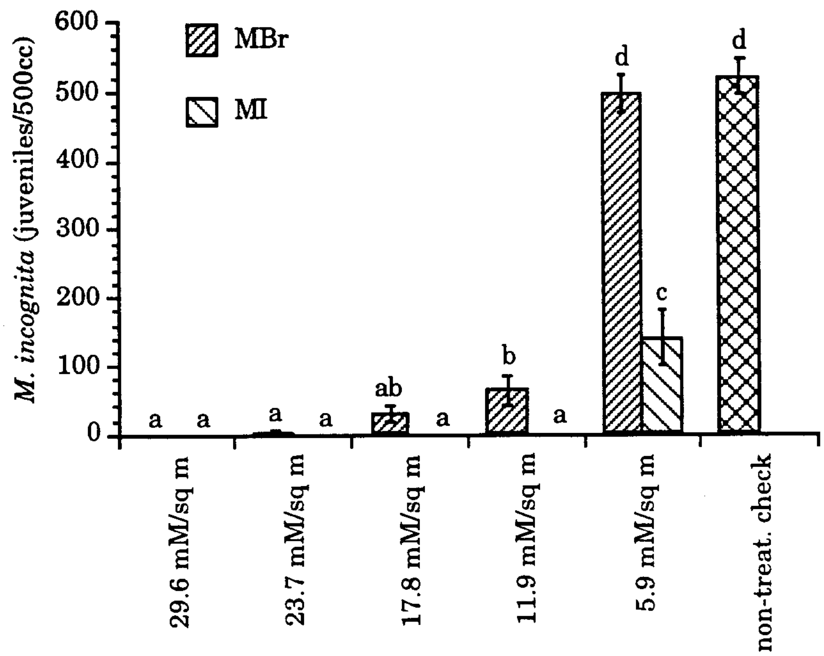

Fig. 1. Efficacy comparison between methyl bromide (MBr) and methyl iodide (MI) against *Meloidogyne incognita* in a bucket trial. Bars indicate standard error. Significant (p=0.05) differences are indicated by different letters.

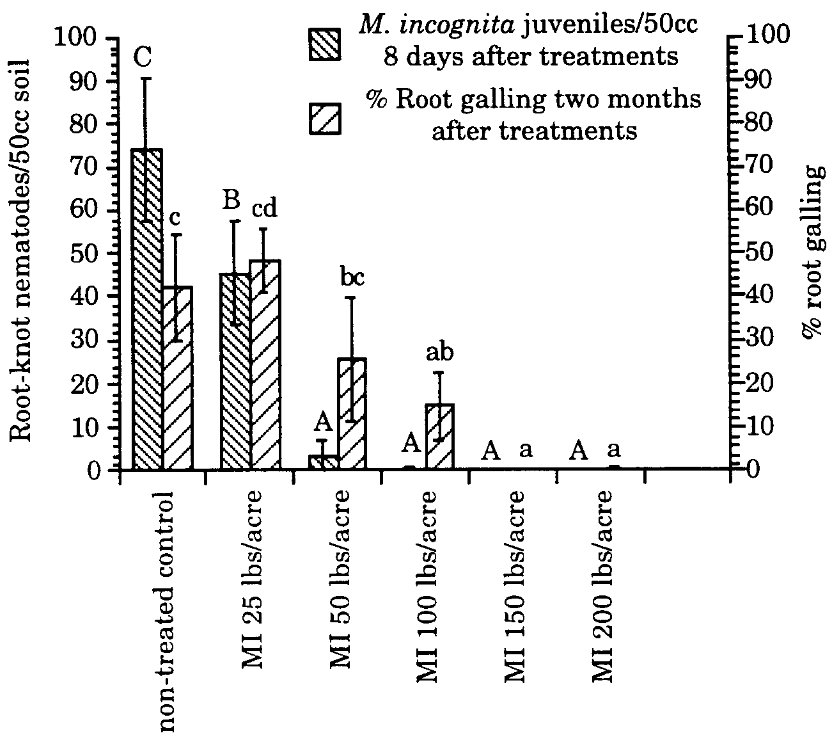

Fig 2. Effect of methyl iodide pre-plant soil fumigation on soil population of *Meloidogyne incognita* and root-knot galling of Lima beans. Bars indicate standard error. Significant (p=0.05) differences are indicated by different letters.